CLAIMS

1. A near real time quality analyzer, comprising:

a passive stream collector that passively samples packets from a stream of Internet Protocol (IP) packets that represent a communication session between a pair of end points carrying analog signals being transmitted over a transmission path in an IP network, and determines in near real time at least two metrics from the sampled packets for the communication session;

wherein the at least two metrics comprise:

at least one metric that measures a quantity of lost packets; and

at least one metric that measures a characteristic of packet timing; and

a stream quality analyzer that receives the at least two metrics and calculates a quality score in near real time using a quality formula that combines the at least two metrics.

2. The near real time quality analyzer according to claim 1, wherein the at least one metric that measures a characteristic of packet timing measures at least one of packet jitter, packet latency, and round trip time.

3. The near real time quality analyzer according to claim 1, wherein the passive stream collector samples packets at a switch.

4. The near real time quality analyzer according to claim 1, wherein the passive stream collector samples all packets entering and leaving a switch.

5. The near real time quality analyzer according to claim 1, wherein the stream quality analyzer receives additional metrics from network devices residing in the IP network along the transmission path, and wherein the quality formula incorporates functions of the additional metrics.

6. The near real time quality analyzer according to claim 5, wherein the additional metrics comprise at least one of a soft switch call metric, call metrics stored

on an end-device, a VoIP (Voice over IP) network component, and a Network Performance Test Probe (NPTP) result.

7. The near real time quality analyzer according to claim 1, wherein the Internet Protocol (IP) packets that represent analog voice signals in which digitized voice is carried in Real Time Protocol (RTP) packets.

8. The near real time quality analyzer according to claim 1, wherein the at least two metrics are derived from data within Real Time Control Protocol (RTCP) packets.

9. The near real time quality analyzer according to claim 1, wherein the quality score is stored in a database indexed to the pair of end points.

10. The near real time quality analyzer according to claim 1, further comprising means for generating an alarm whenever the quality score falls below a quality threshold.

11. The near real time quality analyzer according to claim 1, further comprising a display wherein the quality score is displayed on the display.

12. The near real time quality analyzer according to claim 11, wherein the display further displays historical quality scores associated with the end points.

13. The near real time quality analyzer according to claim 1, wherein the stream quality analyzer aggregates a plurality of quality scores.

14. The near real time quality analyzer according to claim 1, wherein the passive stream collector and the stream quality analyzer are implemented as programmed processes on a computer.

15. The near real time quality analyzer according to claim 1, wherein the quality formula takes the general form of:

$$Q = K_1 + \ln(K_2 + K_3J) + \exp(K_4P)$$

where where Q is the quality score, the K values are constants, J is jitter, and P is packet loss.

16. The near real time quality analyzer according to claim 1, wherein the quality formula takes the general form of:

$$Q = K_5 - K_6L + K_7R + K_8J$$

where Q is the quality score, the K values are constants, L is latency, R is the sum of the squares of round-trip times, where round-trip time is the combined latency for transit between the pair of end points, and J is a minimum positive jitter.

17. The near real time quality analyzer according to claim 1, wherein the quality formula is developed by matching observed quality for communications over the IP network to a standard quality measurement scale, and equating the observed quality to the quality score as the at least two metrics are varied.

18. The near real time quality analyzer according to claim 1, wherein the quality formula is designed to approximate a Perceptual Speech Quality Measurement (PSQM) score.

19. The near real time quality analyzer according to claim 18, wherein an alert threshold level is defined for quality scores of approximately 3.5.

20. The near real time quality analyzer according to claim 18, wherein an alert threshold level is defined for quality scores of approximately 3.3 to 3.7

21. The near real time quality analyzer according to claim 18, wherein an alert threshold level is defined for quality scores of approximately 2.8.

22. The near real time quality analyzer according to claim 18, wherein an alert threshold level is defined for quality scores of approximately 2.5 to 3.1.

23. The near real time quality analyzer according to claim 18, wherein a low level alert threshold level is defined for quality scores of approximately 2.8, and wherein a higher level alert threshold level is defined for quality scores of approximately 3.5.

24. The near real time quality analyzer according to claim 18, wherein quality scores exceeding the low level alert threshold level but not the higher level alert threshold are color coded as yellow quality level, and wherein quality scores exceeding the higher level alert threshold level are color coded as red quality level, and wherein quality scores lower than the low level alert threshold is color coded as a green quality level.

25. The near real time quality analyzer according to claim 1, wherein:

a low level alert threshold and a high level alert threshold are established, and wherein,

quality scores exceeding the low level alert threshold level but not the higher level alert threshold are color coded as yellow quality level, and wherein

quality scores exceeding the higher level alert threshold level are color coded as red quality level,

and wherein quality scores lower than the low level alert threshold is color coded as a green quality level.

26. The near real time quality analyzer according to claim 25, further comprising means for displaying the quality score on a display using color codes for to indicate the quality score's relationship to the alert levels.

27. The near real time quality analyzer according to claim 25, wherein the quality score is compared to at least one threshold that is established either manually or dynamically.

28. A near real time quality analyzer, comprising:

a passive stream collector that passively samples packets from a stream of Real Time Protocol (RTP) Internet Protocol (IP) packets entering and leaving a switch, wherein the stream of packets represents a communication session between a pair of end points carrying analog signals being transmitted over a transmission path in an IP network, and determines in near real time at least two metrics from the sampled packets for the communication session;

wherein the at least two metrics are derived from data contained within Real Time Control Protocol packets comprise:

at least one metric that measures a quantity of lost packets; and

at least one metric that measures a characteristic of packet timing, selected from the group consisting of packet jitter, packet latency, and round trip time;

a stream quality analyzer that receives the at least two metrics and calculates a quality score in near real time using a quality formula that combines the at least two metrics, wherein the stream quality analyzer aggregates a plurality of quality scores;

a database, receiving the quality score from the stream quality analyzer and storing the quality score indexed to the pair of end points;

means for comparing the quality score with a quality threshold and generating an alarm whenever the quality score falls below a quality threshold; and

a display that displays the quality score along with historical quality scores associated with the end points.

29. The near real time quality analyzer according to claim 28, wherein the stream quality analyzer receives additional metrics from network devices residing in the IP network along the transmission path, and wherein the quality formula incorporates functions of the additional metrics.

30. The near real time quality analyzer according to claim 28, wherein:

a low level alert threshold and a high level alert threshold are established, and wherein,

quality scores exceeding the low level alert threshold level but not the higher level alert threshold are color coded as yellow quality level, and wherein

quality scores exceeding the higher level alert threshold level are color coded as red quality level,

and wherein quality scores lower than the low level alert threshold is color coded as a green quality level.

31. A method for near real time quality analysis, comprising:

passively sampling packets from a stream of Internet Protocol (IP) packets that represent a communication session between a pair of end points carrying analog signals being transmitted over a transmission path in an IP network, and determining in near real time at least two metrics from the sampled packets for the communication session;

wherein the at least two metrics comprise:

at least one metric that measures a quantity of lost packets; and

at least one metric that measures a characteristic of packet timing; and

calculating a quality score in near real time using a quality formula that combines the at least two metrics.

32. The method for near real time quality analysis according to claim 31, wherein the at least one metric that measures a characteristic of packet timing measures at least one of packet jitter, packet latency, and round trip time.

33. The method for near real time quality analysis according to claim 31, wherein the packets are sampled at a switch.

34. The method for near real time quality analysis according to claim 31, wherein the samples are taken at a switch, and wherein the samples are taken of all packets entering and leaving the switch.

35. The method for near real time quality analysis according to claim 31, further comprising receiving additional metrics from network devices residing in the IP network along the transmission path, and wherein the quality formula incorporates functions of the additional metrics.

36. The method for near real time quality analysis according to claim 35, wherein the additional metrics comprise at least one of a soft switch call metric, call metrics stored on an end-device a VoIP (Voice over IP) network component, and a Network Performance Test Probe NPTP result.

37. The method for near real time quality analysis according to claim 31, wherein the Internet Protocol (IP) packets that represent analog voice signals in which digitized voice is carried in Real Time Protocol (RTP) packets.

38. The method for near real time quality analysis according to claim 31, wherein the at least two metrics are derived from data in Real Time Control Protocol (RTCP) packets.

39. The method for near real time quality analysis according to claim 31, further comprising storing the quality score in a database indexed to the pair of end points.

40. The method for near real time quality analysis according to claim 31, further comprising generating an alarm whenever the quality score falls below a quality threshold.

41. The method for near real time quality analysis according to claim 31, further comprising displaying the quality score on a display.

42. The method for near real time quality analysis according to claim 41, wherein the display further displays historical quality scores associated with the end points.

43. The method for near real time quality analysis according to claim 31, further comprising aggregating a plurality of quality scores.

44. The method for near real time quality analysis according to claim 31, wherein the process is carried out on a programmed processor.

45. The method for near real time quality analysis according to claim 31, wherein the quality formula is developed by matching observed quality for communications over the IP network to a standard quality measurement scale, and equating the observed quality to the quality score as the at least two metrics are varied.

46. The method for near real time quality analysis according to claim 31, wherein:

the quality formula is designed to approximate a Perceptual Speech Quality Measurement (PSQM) score, and wherein

a low level alert threshold level is defined for quality scores of approximately 2.8, and wherein

a higher level alert threshold level is defined for quality scores of approximately 3.5.

47. The method for near real time quality analysis according to claim 46, wherein quality scores exceeding the low level alert threshold level but not the higher level alert threshold are color coded as yellow quality level, and wherein quality scores exceeding the higher level alert threshold level are color coded as red quality level, and wherein quality scores lower than the low level alert threshold is color coded as a green quality level.

48. The method for near real time quality analysis according to claim 31, wherein:

a low level alert threshold and a high level alert threshold are established, and wherein,

quality scores exceeding the low level alert threshold level but not the higher level alert threshold are color coded as yellow quality level, and wherein

quality scores exceeding the higher level alert threshold level are color coded as red quality level,

and wherein quality scores lower than the low level alert threshold is color coded as a green quality level.

49. The method for near real time quality analysis according to claim 48, further comprising displaying the quality score on a display using color codes for to indicate the quality score's relationship to the alert levels.

50. The method for near real time quality analysis according to claim 31, wherein a packet latency metric is modeled in the quality formula as either an exponential term or a piecewise linear function in which the overall quality score shows a sharp decline in quality when packet latency exceeds approximately 150 ms and a low effect on quality score when packet latency is below approximately 150 ms.

51. The method for near real time quality analysis according to claim 31, wherein a packet loss metric is modeled in the quality formula as either an exponential term or a piecewise linear function in which the overall quality score shows a sharp decline in quality when packet loss exceeds a threshold.

52. The method for near real time quality analysis according to claim 31, wherein a packet latency metric is modeled in the quality formula as an overall formula multiplier.

53. The method for near real time quality analysis according to claim 31, wherein a packet jitter metric is modeled in the quality formula as either a logarithmic term, or a hyperbolic tangent function or as a piecewise linear function.

54. A computer readable storage medium storing instructions which, when executed on a programmed processor, carry out a process of near real time quality analysis, comprising:

passively sampling packets from a stream of Internet Protocol (IP) packets that represent a communication session between a pair of end points carrying analog signals being transmitted over a transmission path in an IP network, and determining in near real time at least two metrics from the sampled packets for the communication session;

wherein the at least two metrics comprise:

at least one metric that measures a quantity of lost packets; and

at least one metric that measures a characteristic of packet timing; and

calculating a quality score in near real time using a quality formula that combines the at least two metrics.

55. The storage medium according to claim 54, wherein the at least one metric that measures a characteristic of packet timing measures at least one of packet jitter, packet latency, and round trip time.

56. The storage medium according to claim 54, wherein the process further comprises storing the quality score in a database indexed to the pair of end points.

57. The storage medium according to claim 54, wherein the process further comprises generating an alarm whenever the quality score falls below a quality threshold.

58. The storage medium according to claim 54, wherein the process further comprises displaying the quality score on a display.

59. The storage medium according to claim 54, wherein the process further comprises aggregating a plurality of quality scores.

60. A computer readable storage medium storing instructions which, when executed on a programmed processor, carry out a process of near real time quality analysis, the instructions comprising:

a first code segment that passively samples packets from a stream of Internet Protocol (IP) packets that represent a communication session between a pair of end points carrying analog signals being transmitted over a transmission path in an IP network, and determining in near real time at least two metrics from the sampled packets for the communication session;

wherein the at least two metrics comprise:

at least one metric that measures a quantity of lost packets; and

at least one metric that measures a characteristic of packet timing; and

a second code segment that calculates a quality score in near real time using a quality formula that combines the at least two metrics.

61. The storage medium according to claim 60, wherein the at least one metric that measures a characteristic of packet timing measures at least one of packet jitter, packet latency, and round trip time.

62. The storage medium according to claim 60, further comprising a code segment that stores the quality score in a database indexed to the pair of end points.

63. The storage medium according to claim 60, further comprising a code segment that generates an alarm whenever the quality score falls below a quality threshold.

64. The storage medium according to claim 60, further comprising a code segment that aggregates a plurality of quality scores.